# Factors influencing adherence to self-care practices among patients of type 2 diabetes mellitus from Saurashtra region of Gujarat: A conclusive research

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## Abstract

**Background:** It is commonly understood that diabetes self-care practice is critical in the management of the disease. However, the magnitude and determinants of self-care practices are not well evaluated at the community level. **Methods:** A community based cross-sectional study was conducted among 178 type 2 DM patients. Self-care practices were evaluated for the last seven days and each item was scored from 0 (none of the days in a week) to 7 (all 7 days were followed). **Results:** Adherence to medication (89.3%) and blood glucose monitoring (65.2%) were relatively higher than other domains. Factors associated with dietary adherence were secondary level education and above (OR = 22.1, 95% CI = 6.85 to 71.3), physician or endocrinologist treating doctors (OR = 3.36, 95% CI = 1.24 to 11.32), joint and three-generation family (OR = 3.32, 95% CI = 1.23 to 8.92) and upper and middle socioeconomic class (OR = 2.5, 95% CI = 1.1 to 6.2). Good glycemic control was significantly associated with dietary adherence (OR = 6.81, 95% CI = (2.71 to 17.16), medication adherence (OR = 4.59, 95% CI = 1.3 to 16.24) and regular exercise (OR = 3.65, 95% CI = 1.62 to 8.19). **Conclusion:** There is need to develop structured diabetes self-care education programs with involvement of private practitioners as a majority of the patients consult private practitioners for treatment. Health educators might have to place emphasis on self-care education to patients as well as caregivers belonging to low socioeconomic class and having lower education.

**Keywords:** Adherence, diabetes mellitus, exercise, medicine, self-care

## Introduction

Diabetes is a non-communicable disease that necessitates daily self-management through the establishment and maintenance of a continuum of care in order to achieve optimal health outcomes.[1] In India, the prevalence of diabetes mellitus (DM) varies from 5% to 14%.[2] Ageing populations, growing urbanisation, dietary changes, decreasing physical activity, and unhealthy behaviour are all contributing to the rise of DM. Indians are also believed to have a higher level of insulin resistance and a higher genetic risk of diabetes.[3]

The role of patients in the management of diabetes is critical in terms of dietary modifications, lifestyle changes, medication compliance, regular foot care, monitoring of blood sugars and avoidance of addiction, etc.[4,5] Self-care is the practice of activities that an individual initiates and performs on his or her own behalf to maintain a healthy life. It is not only a task but also a way of life. Adherence to self-care is difficult to maintain, as it entails

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not only regular blood glucose monitoring but also includes diet modification, regular physical activity, quitting of addiction, foot care practice and medication adherence.[6]

The available literature from India shows suboptimal pharmacological compliance ranging from 23.7% to 46.5% as well as poor non-pharmacology compliance ranging from 23.5% to 52%.[7–9] The factors influencing diabetes self-care practices are early years of diabetes, younger age, living in a rural region, male gender, having comorbidities, low level of awareness, low self-esteem, socioeconomic burden and poor family support.[10]

In countries with limited resources like India, treatment costs for diabetes are constantly rising. The self-care component may lead to improved therapeutic and economic outcomes.[11] Although it is commonly understood that self-care practice is critical in the management of the disease, the magnitude and determinants of self-care practices are not well evaluated at the community level. Therefore, this community-based study aimed to assess the level of self-care practices and associated factors among type 2 DM patients of Surendranagar city of Saurashtra, Gujarat.

**Objectives: (**a) To access the level of self-care practice and factors associated with adherence of self-care practice among type 2 DM patients. (b) To evaluate the relationship between self-care practice and glycaemic control.

## Materials and Methods

Type of study: A community based cross-sectional study was conducted at Surendranagar city of Gujarat, India for one year after receiving permission from an institutional ethics committee. Sample size: It was calculated through $z^2pq/d^2$ formula using 10% prevalence of diabetes from a study by Niti S *et al.*[12] and 95% confidence interval. Taking 10% non-response rate, the final sample size was 3600. There are 14 wards in Surendranagar city. Out of which, 6 wards were selected through a simple random technique. From each ward, 600 adult persons were identified through a house-to-house survey. Out of the total 3600 study population, 178 participants (4.94%) were found to be diabetic and were included for final analysis.

Inclusion criteria: More than 18 years old having type 2 DM who are on treatment for at least 1 year duration, either those on oral hypoglycaemic agent (OHA) treatment or those on combined therapy (OHA + Insulin).

Exclusion criteria: Patients exclusively on insulin therapy, bed ridden, and pregnant women were excluded.

Data collection: After obtaining informed consent, diabetic patients were interviewed regarding diabetes self-care practices through a structured questionnaire. It included sociodemographic variables and various domains of self-care practices such as dietary practice, foot care, exercise, medication, glycaemic status and avoidance of addiction. Self-care practices were evaluated

for last seven days and each item was scored from 0 (none of the days in a week) to 7 (all 7 days were followed) and score ≥ 5 was considered as satisfactory adherence for dietary practice and exercise. Examination of feet and between the toes at least once in a week was considered as satisfactory foot care adherence. Blood glucose monitoring once in three months was considered satisfactory adherence. Satisfactory adherence for medication was considered if taken for all seven days as per prescribed by the doctor. Glycaemic control was classified as poor control (HbA1c ≥7) and good control (HbA1c <7).[13,14]

Data analysis: It was done using Epi info version 7.1.4.0. Quantitative data such as age, duration of diabetes, etc., was described with mean and standard deviation and self-care practice domains were described using frequency and percentage. The association of self-care practice with sociodemographic profile was analysed using Chi-squared test and multivariate binary logistic regression. The relationship between self-care practices and glycaemic control was also analysed using Chi-squared test and binary logistic regression. An odds ratio (OR) of more than 1 and *P* value less than 0.05 were considered as significant.

## Results

Table 1 shows the sociodemographic characteristics and diabetic profile of study participants. Of 178 diabetics, 94 (52.8%)

| Table 1: Sociodemographic characteristics and diabetic profile of study participants | |
| --- | --- |
| Characteristics | Frequency (%) |
| Age (years) | |
|   < 60 | 110 (61.8%) |
|   ≥ 60 | 68 (38.2%) |
|   Mean±SD | 57.7±11.9 |
| Male/Female | 94/84 (1.2:1) |
| SE Class (Modified Kuppuswamy scale) | |
|   Upper and middle (Class I II & III) | 83 (46.6%) |
|   Lower (Class IV & V) | 95 (53.4%) |
| Education | |
|   Illiterate and primary | 135 (75.8%) |
|   Secondary and above | 43 (24.2%) |
| Type of family | |
|   Nuclear | 92 (51.7%) |
|   Joint | 6 (3.4%) |
|   Three generation | 80 (44.9%) |
|   Family size (median) | 5 |
| Addiction of any substance | 77 (43.2%) |
| Duration of diabetes (years) | 7.58±5.32 |
| Qualification of treating doctors | |
|   Not taking treatment | 13 (7.3%) |
|   BAMS or BHMS | 19 (10.7%) |
|   MBBS | 21 (11.8%) |
|   MD - Physician | 122 (68.5%) |
|   Endocrinologist | 3 (1.7%) |
| Glycaemic control | |
|   Controlled | 106 (59.5%) |
|   Not controlled | 72 (40.4%) |

were male. The mean age of diabetics was 57.7 ± 11.9 years. A majority of them belonged to the lower class (Class IV & V - 95, 53.4%) and 135 patients (75.8%) had received education up to the primary level. Out of 178 diabetics, 92 diabetics (51.7%) belonged to a nuclear family and median family size was 5. About 43.2% of diabetics had addiction of one or more substances. Mean duration of diabetes was 7.88 ± 5.32 years. About 7.3% of patients were not consulting a doctor for treatment; 68.5% of patients were treated by physicians. More than half of the diabetics (106, 59.5%) had good glycaemic control.

Table 2 depicts the overall adherence to different domains of self-care practices. Out of all the domains, foot care practice was least followed (16, 9.0%) among diabetics. Only 64 patients (36.0%) followed satisfactorily in the dietary practice and 85 patients (47.8%) in the exercise domains. Adherence to medication (89.3%) and blood glucose monitoring (65.2%) were relatively higher than other domains.

Table 3 shows binary logistic regression analysis of factors associated with self-care practice adherence. Binary logistic regression shows that factors associated with dietary adherence in descending order were secondary level education and above (Odds ratio (OR) = 22.1, 95% Confidence interval (CI) = 6.85 to 71.3), MBBS, MD or DM treating doctors (OR – 3.36, 95% CI - 1.24 to 11.32), joint and three-generation family (OR = 3.32, 95% CI = 1.23 to 8.92) and upper and middle socioeconomic class (OR = 2.5, 95% CI = 1.1 to 6.2). Similarly, upper and middle socioeconomic class (OR = 2.79, 95% CI = 1.36 to 5.71) and secondary level and above education (OR = 1.76, 95% CI = 1.12 to 3.93) were significantly associated with exercise adherence. Binary logistic regression showed regular blood glucose was only observed in patients taking treatment from MBBS, MD or DM (OR = 1.95, 95% CI = 1.32 to 3.5). Factors associated with foot care adherence in descending order were secondary or higher education (OR = 2.42, 95% CI = 1.44 to 8.12) and treating doctors with MBBS, MD or DM degree (OR = 1.82, 95% CI = 1.21 to 7.53). Medication adherence was higher among patients taking treatment from doctors with MBBS, MD or DM degree (OR = 2.03, 95% CI = 1.24 to 6.39) and secondary- or higher-level education (OR = 1.93, 95% CI = 1.12 to 7.24). Avoidance of addiction was not associated with any factor in univariate and regression analysis. Univariate analysis showed that patients with satisfactory adherence to dietary practice, exercise and medication had HbA1c <7% [Table 4].

## Table 2: Domain-wise distribution of self-care practices among diabetics

| Self-care practices domain | Satisfactory | Unsatisfactory |
| --- | --- | --- |
| Diet (*n*=178) | 64 (36%) | 114 (64%) |
| Exercise (*n*=178) | 85 (47.8%) | 93 (52.2%) |
| Foot care (*n*=178) | 16 (9%) | 162 (91%) |
| Appropriate blood sugar check-up (*n*=178) | 116 (65.2%) | 62 (34.8%) |
| Adherence to medications (*n*=178) | 159 (89.3%) | 19 (10.7%) |
| Avoiding addiction (*n*=77) | 11 (14.3%) | 66 (85.7%) |

## Table 3: Binary logistic regression analysis of factors associated with self-care adherence

| Variable | Self-care component (Odds ratio, 95% CI of OR, *P*) | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | Dietary adherence | Adherence to exercise | Blood glucose monitoring | Foot care adherence | Medications adherence | Avoidance of addiction |
| Age (< 60 years) | 0.15 (0.03 to 0.58), 0.007 | 0.74 (0.30 to 1.84), 0.52 | 0.32 (0.12 to 0.83), 0.32 | 1.31 (0.26 to 6.58), 0.74 | 0.64 (0.16 to 2.63), 0.53 | 1.68 (0.28 to 9.96), 0.56 |
| Gender (Male) | 0.23 (0.09 to 0.61), 0.003 | 0.41 (0.20 to 0.83), 0.01 | 0.47 (0.22 to 0.93), 0.05 | 0.62 (0.14 to 2.68), 0.52 | 0.41 (0.13 to 1.30), 0.13 | 0.06 (0.01 to 0.30), 0.001 |
| Socioeconomic class (I, II, III) | 2.5 (1.1 to 6.2), 0.04* | 2.79 (1.36 to 5.71), 0.005* | 1.04 (0.51 to 2.13), 0.90 | 0.71 (0.20 to 2.45), 0.59 | 0.52 (0.12 to 2.35), 0.40 | 0.07 (0.01 to 0.49), 0.007 |
| Education (Secondary and above) | 22.1 (6.85 to 71.3), < 0.001* | 1.76 (1.12 to 3.93), 0.04* | 0.51 (0.22 to 1.12), 0.09 | 2.42 (1.44 to 8.12), 0.02* | 1.93 (1.12 to 7.24), 0.04* | 0.01 (0.01 to 0.70), 0.24 |
| Type of family (Joint & Three generation) | 3.32 (1.23 to 8.92), 0.01 | 1.72 (0.81 to 3.78), 0.15 | 0.71 (0.33 to 1.50), 0.37 | 0.25 (0.06 to 1.09), 0.99 | 1.19 (0.36 to 3.85), 0.76 | 0.12 (0.01 to 1.04), 0.06 |
| Treating doctor (MD, Endocrinologist) | 3.36 (1.24 to 11.32), 0.04* | 1.52 (0.62 to 3.67), 0.35 | 1.95 (1.32 to 3.5), 0.02* | 1.82 (1.21 to 7.53), 0.03* | 2.03 (1.24 to 6.39), 0.03* | 0.51 (0.12 to 2.25), 0.38 |
| Duration of diabetes (>10 years) | 1.28 (0.26 to 6.15), 0.76 | 3.11 (1.20 to 10.04), 0.04 | 1.36 (0.49 to 3.71), 0.54 | 3.55 (0.43 to 29.43), 0.24 | 1.65 (0.24 to 11.39), 0.66 | 0.53 (0.17 to 1.60), 0.26 |
| Significant variable | SE class, Education, Type of family, Treating doctor | SE class, Education | Treating doctor | Education, Treating doctor | Education, treating doctor | No variable |

*P-value less than 0.05 was considered as significant

| Self-care component | Adherence | Glycaemic control | | P |
|---|---|---|---|---|
| | | Yes | No | |
| Diet | Satisfactory (*n*=64) | 56 (87.5%) | 8 (12.5%) | < 0.001* |
| | Unsatisfactory (*n*=114) | 50 (43.9%) | 64 (56.1%) | |
| Exercise | Satisfactory (*n*=85) | 66 (77.6%) | 19 (22.4%) | < 0.001* |
| | Unsatisfactory (*n*=93) | 40 (43%) | 53 (57%) | |
| Glucose monitoring | Satisfactory (*n*=116) | 70 (60.3%) | 46 (39.7%) | 0.76 |
| | Unsatisfactory (*n*=62) | 36 (58.1%) | 26 (41.9%) | |
| Foot care | Satisfactory (*n*=16) | 10 (62.5%) | 6 (37.5%) | 0.8 |
| | Unsatisfactory (*n*=162) | 96 (59.3%) | 66 (40.7%) | |
| Medication | Satisfactory (*n*=159) | 102 (64.2%) | 57 (35.8%) | < 0.001* |
| | Unsatisfactory (*n*=19) | 4 (21.1%) | 15 (78.9%) | |
| Addiction | Non addicted (*n*=101) | 60 (59.4%) | 41 (40.6%) | 0.93 |
| | Quit addiction after diagnosis of DM (*n*=11) | 6 (54.5%) | 5 (45.5%) | |
| | Current addiction (*n*=66) | 40 (60.6%) | 26 (39.4%) | |

Table 4: Univariate analysis for association between self-care practice and glycaemic control

*P-value less than 0.05 was considered as significant

Binary logistic regression was used to analyse the association between self-care practice and glycaemic control which is shown in Figure 1. Good glycaemic control was observed in patients with dietary adherence (OR = 6.81, 95% CI = 2.71 to 17.16), medication adherence (OR = 4.59, 95% CI = 1.3 to 16.24) and regular exercise (OR = 3.65, 95% CI = 1.62 to 8.19).

## Discussion

Self-care practices are cornerstones of diabetic control and reduce diabetes-related complications. Diabetes self-care is multi-dimensional and it is essential to evaluate each component separately.[15]

### Components of self-care practice

Diet planning is the mainstay in self-management and control of diabetes.[16] However, only 36.0% of patients were consuming anti-diabetic diet satisfactorily in the present study. Various other studies from India noted 30% to 71% dietary adherence.[7,13,17] This variation may be because of a different geographical and sociocultural environment. In the present study, dietary adherence was found to be higher among diabetic patients having secondary level or higher education (OR = 22.1), joint and three-generation family (OR = 3.32) and belonging to the upper and middle socioeconomic class (OR = 2.5), and receiving treatment from doctors with MBBS, MD or DM degree (OR = 3.36). It could be because many of the diabetic patients rely on family members for preparing meals, buying groceries, etc. Family members play a central role for counselling and compliance. Therefore, they should receive self-care practice education. Mohandas A *et al.*[18] also revealed that the absence of family support had a detrimental impact on dietary adherence. Patel M *et al.*[19] revealed that dietary compliance was shown to be substantially linked with the consulting dietitian (OR = 10.6), consumption of low-fat foods (OR = 2.2), having higher level of education (OR = 3.5) and having a positive family history (OR = 1.8). Parajuli J *et al.*[20] reported that male diabetic patients, those staying nearer to hospital, those advised by
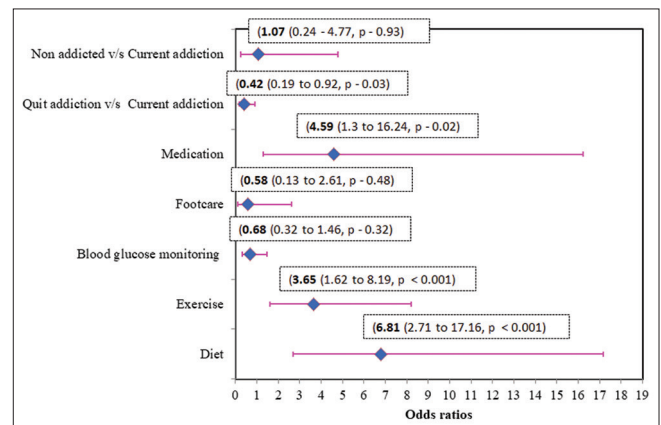


**Figure 1:** Binary logistic regression for association between self-care practice and glycaemic control

physician, and those from a nuclear family were more likely to follow dietary recommendations.

In the present study, regular exercise was practiced by 47.8% diabetics. The rate of adherence to exercise varied between 20% to 61%.[7,13,17,21] In the present study, adherence to exercise was more commonly observed among diabetic patients in the upper and middle socioeconomic class (OR = 2.79) and secondary level and above education (OR = 1.76) which almost matches with other studies.[20,21] It was reported that physical activity adherence was higher in male patients, patients from upper middle socioeconomic class, joint and extended family and those with positive family history.[20,21] Physical activity adherence was also influenced by social network, counselling by healthcare professionals and the availability of facilities or pleasant and safe places.[22]

In the present study, satisfactory adherence was very low for foot care (9.0%). Similarly, foot care adherence was found to be very poor in a majority of Indian studies ranging from 15.1% to 35%.[13,23,24] In the present study, foot care practice was regularly followed by patients with higher education (OR = 2.42) and those

who were treated by a physician or endocrinologist (OR = 1.82). Other earlier studies revealed that male gender, monthly family income >30,000 INR,[25] and patients with more than 10 years duration of diabetes were more likely to follow foot care practice.[11] Suguna A *et al.*[14] did not find any relationship between foot care adherence and sociodemographics variable such as gender, education and per capita income.

In the present study, only two-thirds of patients were compliant in regular blood glucose check-ups which was low as compared to Gopichandran V *et al.*[13] (70%), Durai V *et al.*[21] (90%). In the present study, patients receiving treatment from a physician or endocrinologist had regular blood glucose check-up (OR = 1.95). According to Rajasekharan D *et al.*[11] and Mohandas A *et al.*,[18] younger diabetic patients (<50 years) performed blood glucose testing more frequently than older diabetic patients (≥50 years).

Good medication adherence is vital for maintaining good glycaemic control which prevents diabetic complications. This study showed a high level of adherence to medication (89.3%). Previous studies conducted in India reported lower medication adherence ranging from 61% to 80%.[7,13,17,21] It might be because of diversity of assessment tool for medication adherence. In the present study, medication compliance was higher among patients taking treatment from a physician or endocrinologist (OR = 2.03) and having secondary level or higher education (OR = 1.93), and it was not associated with age, gender, socioeconomic class, type of family and duration of diabetes. Durai V *et al.*[21] also reported that medication compliance had no relationship with age, gender, age, or education level. However, various other studies across the world reported that upper socioeconomic status, being female, higher education level, and duration of diabetes <5 years were significant factors for good adherence to medication among diabetic patients.[26,27]

In the present study, adherence to cessation of addiction after diagnosis of diabetes was present only 14.3% patients. Durai V *et al.*[21] also observed low rate of avoidance of addiction (30%).

## Factors associated with self-care practice

Higher education may contribute to greater judgement and decision-making ability for adhering to self-care behaviours. In the present study, diabetic patients with higher education had better adherence to diet, medication, exercise and foot care practice. Three-fourth of patients had limited literacy skills as they were educated only up to the primary level. Therefore, counselling should be carefully tailored to their level of understanding. Counselling sessions with charts, pictograms for medicine regimen, diet modification and foot care are quite beneficial. Luo X *et al.*[28] also revealed that patients with higher educational level maintained foot care, regular blood glucose monitoring and good dietary adherence.

In the present study, patients belonging to the upper and middle socioeconomic class followed dietary advice and physical activity. Lack of cost-effective facilities and affordability of fruits and green leafy vegetables are obstacles for low-income patients for participating in physical activity and diet adherence. However, medication, blood glucose monitoring and foot care adherence were not associated with socioeconomic status. It might be because of very much low out of pocket expenditure for medicine and blood glucose monitoring as these facilities are available free of cost at government health care facilities. The influence of socioeconomic status in determining self-care behaviours was also explored by Karthik RC *et al.*[29]

In the present study, patients belonging to joint and extended families had higher dietary adherence. Family support helps patients with greater self-acceptance and management of a routine schedule of diet. Luo X *et al.*[28] observed in a meta-analysis that family support was significantly associated with regular physical activity, blood glucose monitoring and foot care.

In the present study, patients taking treatment from a physician or endocrinologist were more likely to follow diet modifications, blood glucose monitoring, foot care and prescribed medications than those taking treatment from a general practitioner.

In the present study, age, gender and duration of diabetes were not associated with self-care practice. In the meta-analysis conducted by Luo X *et al.*,[28] it was observed that younger diabetic patients were adherent to overall self-care practice than others and longer duration of diabetes was positively related to blood glucose monitoring, diet modification and exercise.

Abate TW *et al.*[6] included 21 studies for meta-analysis to investigate factors related to non-adherence to self-care practice. Male (OR = 1.84), lower education (OR = 2.89), having private glucometer (OR = 2.71), short-term DM duration (OR = 3.69), complication (OR = 2.22), treatment satisfaction (OR = 1.8), received diabetes self-management education (OR = 2.71) and poor self-efficacy (OR = 3.09) were all statistically significant factors of non-adherence to self-care practice.

## Self-care practice and glycaemic control

In the present study, good glycaemic control was shown to be associated with dietary adherence (OR = 6.81), medication adherence (OR = 4.59) and regular exercise (OR = 3.65). This agreed with findings of Sasi ST *et al.*[17] and Durai V *et al.*[21] They also reported that patients following dietary recommendation and taking medication regularly had good glycaemic control. However, compliance to physical activity and regular blood glucose monitoring were not associated with glycaemic control.[17,21]

Strength: Being a community-based study, the present study has significant advantage over a hospital-based study in assessing the actual adherence among diabetic patients. This is because all of the patients who did not visit the hospital were also included and addressed in the present study and they are the people who are at most risk for non-adherence to self-care activities.

## Limitation

Confounders such as media exposure to diabetes-related information, family history of diabetes, comorbidities, additional use of indigenous systems of medicines, etc., may be present and are not taken into account in the present study. Cause and effect relationships may not be very evident because of inherent issues of temporality as the present study was cross-sectional study. Self-care practice of the previous seven days was evaluated; therefore, data regarding duration of adherence of self-care practice was not collected. Duration of self-care practice adherence has an impact on glycaemic control.

## Conclusion

In this study, compliance with medication and regular blood sugar check-up was high with respect to physical activity, dietary practices, foot care practices. Patients with higher education, upper and middle socioeconomic class, having family support, taking treatment from physician and endocrinologist had better self-care adherence. There is a need to develop structured diabetes self-care education programs with the involvement of private practitioners as the majority of the patients consult private practitioners for treatment. The importance of self-care education among primary care doctors should be enriched with continuing medical education (CME). Health educators might have to give emphasis on self-care education to patients from the low socioeconomic class and lower education. Caregivers also should be educated as family support is crucial in self-care management. Adherence to self-care practice through behaviour change communication is very useful for improving glycaemic control in diabetic patients.

## Ethical approval

The study was approved by the Institutional Ethics Committee.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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